40th Leeds-Lyon Symposium on Tribology & Tribochemistry Forum 2013
September 4-6, 2013, Lyon, France

Laboratory test to evaluate the effect of contaminants on road skid resistance

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1. Introduction

Road surface skid resistance varies throughout the year. The friction coefficient is the highest in the winter and lowest in the summer. This so-called seasonal variation is generally attributed to temperature, traffic and weather effect on aggregates.

This paper deals with the effect of contaminants on skid resistance seasonal variations. This effect has been overlooked and yet plays a significant role in the friction difference between summer and winter. Review of contaminant effect on tire/road friction is first presented. A laboratory test method, aiming at reproducing in-situ observations, is then proposed.

2. Effect of contaminants on tire/wet road friction

Contaminants can originate from different sources such as: atmosphere (dust), traffic (tire and road debris), winter maintenance (salt). The particles are deposited on the road surface, mainly in summer. At the first rain after a dry period, these particles are mixed with water drops and form a viscous lubricant. Water runoff then sweeps the particles and washes the road surface. The consequence of the cycle particle deposit-mixing with water-washing on friction variation with time is shown qualitatively in figure 1.

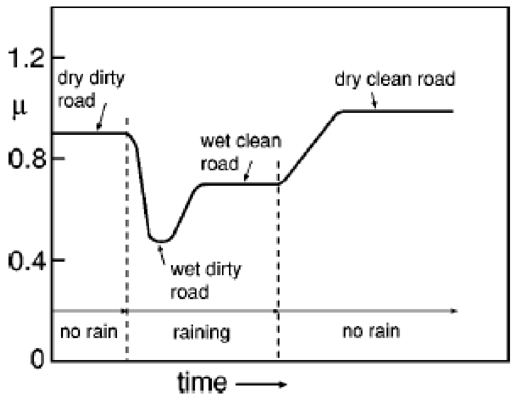

Fig.1 Dependency of friction on time during rain [1]

3. Laboratory test

There is a need to develop a laboratory test to reproduce the graph shown in figure 1. The test will help to better understand the effect of meteorology (duration of dry periods, rain frequency and intensity) on the periodicity and the amplitude of seasonal variations. Complementary characterizations (not dealt with in the paper) such as lubricant – mix of contaminants and water – viscosity and surface wettability will also help to explain the friction variation.

Protocol to deposit contaminant particles (extracted from wastewater basins) on road specimen is described. The protocol takes into account the compaction effect due to traffic. Given quantity of water simulating rain intensity is sprayed on the specimen and friction measurement is performed soon after. Graphs representing friction-measurement run number or friction-water depth can be plotted.

4. Results

Typical result is shown in figure 2. It can be seen that the test method reproduces remarkably well the tendency in figure 1. Discussions are made with respect to the link between, on the one hand, the contaminant nature and quantity and the water quantity, and on the other hand, the friction drop (slope, minimum value) and recovery by washing effect.

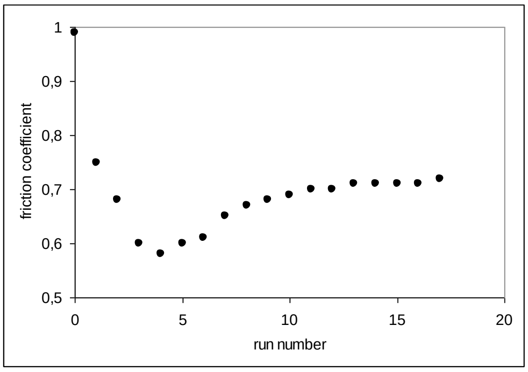

Fig.2 Results from laboratory test

Moreover, the role of surface microtexture is investigated. Descriptors of surface roughness (asperity height, shape and density as those used in [2]) are used to quantify the masking (by contaminants) and washing (by water) effects, and their consequences on friction coefficient.

Perspectives are provided in terms of comparison between laboratory and road data and modeling.

5. References

[1] Persson, B. N. J., Tartaglino, U., Albohr, O. and Tosatti, E., "Rubber Friction on Wet and Dry Road Surfaces: The Sealing Effect", Physical Review, B71, 2005, DOI: 10.1103/PhysRevB.71.035428.

[2] Do, M.T., Tang, Z., Kane, M. and de Larrard, F., "Evolution of road-surface skid-resistance and texture due to polishing", Wear 266 (2009) 574-577.